

REMARKS

Claims 7-10, 14-17 and 20 are amended. Claims 1-6, 11, 12, 18, 22-33 and 35-45 are cancelled. Claims 46-64 are added. Claims 7-10, 14-17, 19-21 and 46-64 are in the application for consideration.

Independent claim 16 stands rejected under 35 U.S.C. §112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that, at the time the application was filed, the inventor had possession of the claimed invention. The language objected to has been deleted from claim 16. However, such language is provided in added claims 46 and 53. Applicant strongly disagrees with the rejection and requests reconsideration.

The undersigned asserts that the entirety of the application as-filed must be considered by the Examiner, and that such has not been considered by the Examiner in light of the new matter and §112 rejection. On page 16 of the application and in its claims as originally filed, Applicant did utilize the word "comprising" with respect to the etching chemistry with ammonia and at least one fluorocarbon. However, language appearing on page 8 of Applicant's specification as-filed clearly supports Applicant's position that claims 46 and 53 do not constitute new matter and are in compliance with 35 U.S.C. §112. Specifically, page 8 provides:

A reduction-to-practice example utilized an Applied Materials 5000 Etch Chamber, with a CF_4 flow of 50 sccm, a CHF_3 flow of 20 sccm and an ammonia flow of 5 sccm. The ammonia flow rate is preferably kept at or below 8 sccm.

One or more of the fluorocarbons and the ammonia may be introduced into the reaction chamber substantially simultaneously, or successively. Other etching gases can, of course, be introduced into the reaction chamber together with the foregoing ammonia and fluorocarbon(s), with examples being carrier gasses, oxygen, nitrogen and other compounds.

Accordingly, the above first paragraph of the specification as-filed specifically provides an example having only CF_4 , CHF_3 and ammonia therein. The immediate next paragraph of the above-quoted section also indicates that other etching gasses can be utilized, including carrier gasses (which are inherently inert), oxygen, nitrogen and other compounds.

A person of skill in the art would know, and Applicant's originally submitted disclosure supports, a conclusion that CF_4 , CHF_3 and NH_3 constitute "reactive components" of the etching chemistry. Therefore, such is inherent in the specification as-filed, and thereby, does not constitute new matter. Clearly, in the context of Applicant's disclosure as-filed, each of these stated gasses in the exemplary chemistry is reactive, and thereby not inert. Accordingly, no new matter is added.

Further, the above-quoted language clearly indicates the possibility of utilizing only these materials, or with the addition of other gasses, which are disclosed as including inert-type carrier gasses and/or other gasses which may or may not be reactive. Accordingly, the disclosure inherently teaches to a person of skill in the art to utilize reactive gasses alone as only being ammonia and at least one fluorocarbon, as well as the addition of no or any portion of other gasses. Therefore, the disclosure clearly shows that Applicant did, at the time of filing, have and did disclose having the reactive components restricted to ammonia and at least one fluorocarbon by the above originally filed material, and accordingly, that the reactive components would include consisting essentially of ammonia and at least one fluorocarbon. Such is inherent from the application as-filed, and a person of skill in the art would clearly recognize such. For the foregoing reasons, the Examiner's 35 U.S.C. §112, first paragraph rejection and new matter rejection should be withdrawn, and action to that end is requested.

The Examiner's 35 U.S.C. § 112, second paragraph rejections are obviated by the cancellation of the subject claims.

Claim 16 is amended to delete the limitation to plasma etching, with such being added in the form of amended claim 8. With there being no prior art rejection of claim 16 in the outstanding Office Action, summary allowance thereof is warranted, and requested.

Independent claim 20 stands rejected as being obvious over a combination of Wolf, Ding et al. and JP '071. Applicant disagrees and requests reconsideration.

The Examiner asserts that the JP '071 reference teaches etching silicon nitride films and using ammonia as a nitrogen source. At present, the undersigned only has access to the copy of JP '071 provided by the Examiner, which includes an English abstract attached to the front thereof. The undersigned does not read Japanese, but finds nothing therein in the English language alphabet characters, nor in the English abstract, which indicates using ammonia as a nitrogen source with or without a CO₂ gas. If the Examiner has some abbreviated or other translation of this document beyond that which has been provided to the undersigned, it is respectfully requested that whatever additional translation information the Examiner has also be provided to the undersigned. Regardless, independent claim 20 is not seen to be obvious over the cited combination of references.

Specifically, claim 20 includes the limitation of the etching chemistry comprising ammonia and at least one of C₄F₆ and C₅F₈ in etching silicon nitride substantially selectively relative to a photoresist comprising material where increased selectivity is provided than would otherwise occur in the absence of ammonia. However, the English abstract of '071 clearly teaches etching both

photoresist and silicon nitride using a chemistry involving C_5F_8 . Therefore, etching selectivity and the other methodical aspects of Applicant's claim 20 are not taught by this reference, and in fact, the opposite of the claimed selectivity is taught. Accordingly, the JP '071 reference specifically teaches against its combination with the '563 Ding et al. patent, which does teach not etching photoresist, and rather a selective etching process relative thereto. Thus, the Japanese reference inherently teaches against the very combination which the Examiner makes, and away from Applicant's independent claim 20. Accordingly, the rejection is seen to be in error and should be withdrawn. Action to that end is requested.

New claims 46-64 are added. Claims 49, 50, 63 and 64 recite various shallow trench isolation forming methods in conjunction with aspects of cancelled claims 22-33, 35-43 and 45. Accordingly, no new matter is added thereby.

Added claims 47 and 54 are supported by the application as-filed at p.6, lns.4-6. Dependent claims 48 and 55 are supported in the application as-filed in the above quoted language from the specification. Accordingly, no new matter is added thereby.

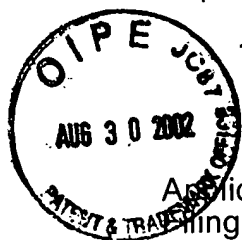
Each of Applicant's dependent claims presented herein should be allowed as depending from allowable base claims, and for their own recited features which are neither shown nor suggested in the cited art. Action to that end is requested.

This application is believed to be in immediate condition for allowance, and action to that end is requested.

Respectfully submitted,

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application Serial No. 09/920,978
Filing Date August 1, 2001
Inventor Shane J. Trapp
Assignee Micron Technology, Inc.
Group Art Unit 2813
Examiner David S. Blum
Attorney's Docket No. MI22-1674
Title: Method of Forming Integrated Circuitry and Method of Forming Shallow
Trench Isolation in a Semiconductor Substrate

VERSION WITH MARKINGS TO SHOW CHANGES MADE
ACCOMPANYING RESPONSE TO MAY 30, 2002 FINAL OFFICE ACTION

In the Claims

The claims have been amended as follows. Underlines indicate insertions
and ~~strikeouts~~ indicate deletions.

Claims 1-6 are cancelled.

7. (Twice Amended) The method of claim 6 16 wherein the etching
chemistry comprises a volumetric ratio of all fluorocarbon to the ammonia of at
least 20:1.

8. (Amended) The method of claim 4 16 wherein the etching comprises
plasma etching.

9. (Amended) The method of claim 4 16 wherein the etching comprises
magnetically enhanced plasma etching.

10. (Amended) The method of claim 4 16 wherein the etching comprises substantially anisotropic etching of the silicon nitride comprising layer.

Claims 11 and 12 are cancelled.

14. (Amended) The method of claim 4 16 wherein the etching chemistry comprises at least two fluorocarbons.

15. (Amended) The method of claim 4 16 wherein the etching chemistry comprises at least three fluorocarbons.

16. (Twice Amended) A method of forming integrated circuitry comprising:
forming a layer comprising silicon nitride over a semiconductor substrate;
forming a patterned photoresist comprising masking layer over the silicon nitride layer, the patterned masking layer comprising mask openings therethrough;
and

~~plasma~~ etching the silicon nitride comprising layer through the mask openings substantially selectively to the photoresist comprising layer using an etching chemistry ~~consisting essentially of reactive components of~~ comprising ammonia and at least one fluorocarbon under etching conditions effective to substantially anisotropically etch the silicon nitride comprising layer, the etching chemistry comprising a volumetric ratio of all fluorocarbon to the ammonia of from 40:1 to ~~3:1~~ 9:1 and providing increased selectivity to the photoresist comprising masking layer than would otherwise occur using identical etching chemistry and identical etching conditions without any ammonia.

17. (Amended) The method of claim 16 wherein the etching chemistry comprises a volumetric ratio of all fluorocarbon to the ammonia of ~~no less than 6:1~~ at least 20:1.

Claim 18 is cancelled.

20. (Twice amended) A method of forming integrated circuitry comprising:
forming a layer comprising silicon nitride over a semiconductor substrate;
forming a patterned photoresist comprising masking layer over the silicon
nitride layer, the patterned masking layer comprising mask openings therethrough;
and

~~plasma~~ etching the silicon nitride comprising layer through the mask
openings substantially selectively to the photoresist comprising layer using an
etching chemistry comprising ammonia and at least one fluorocarbon under
etching conditions effective to substantially anisotropically etch the silicon nitride
comprising layer, the etching chemistry comprising a volumetric ratio of all
fluorocarbon to the ammonia of from 40:1 to 3:1 and providing increased
selectivity to the photoresist comprising masking layer than would otherwise occur
using identical etching chemistry and identical etching conditions without any
ammonia, wherein the fluorocarbon is at least one member selected from the
group consisting of C_4F_6 and C_5F_8 .

Claims 22-33 and 35-45 are cancelled.

New claims 46-64 are added.

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